Registration Number:

Date & session:

ST JOSEPH'S UNIVERSITY, BENGALURU -27
M.Sc. (STATISTICS) – 2nd SEMESTER
SEMESTER EXAMINATION: APRIL 2024
(Examination conducted in May / June 2024)
ST 8321 – MULTIVARIATE ANALYSIS
(For current batch students only)

Time: 2 Hours **Max Marks: 50**

This paper contains TWO printed page and ONE part

PART-A

Answer any FIVE of the following **10 X 5 = 50**

1. A) Define the multivariate normal distribution. Mention any two properties of variance covariance matrix of multivariate normal.
   B) Mention the MGF of multivariate normal distribution. Using its MGF show that $Y = DX$ (D is a matrix) follows multivariate normal if X follows multivariate normal.
   C) Briefly explain the procedure to obtain QQ plot. (3+3+4)

2. A) Give two examples of multivariate data.
   B) Write down the likelihood function of parameters of multivariate normal vector and derive the maximum likelihood estimator of the variance covariance matrix.
   C) Define optimum error rate (OER) and obtain the expression for OER for a classification problem related to two normal populations. (2+5+3)

3. A) If $X_1, X_2, \ldots, X_n$ is a random sample of size n from a multivariate normal distribution with mean vector μ and variance covariance matrix Σ, derive the likelihood ratio test to test the hypothesis $H_0: \mu = \mu_0$ vs $H_1: \mu \neq \mu_0$.
   B) What do you mean by canonical discriminant analysis. (8+2)

4. A) Explain the method of classification of the observation in case of two multivariate population.
   B) Define a multivariate regression model. How do you estimate the parameters of the multivariate regression model? (4+6)

5. A) Explain the concept of PCA when characteristic roots are equal.

B) Prove that the variance of the first principal component corresponds to the largest characteristic root of the dispersion matrix. (4+6)

6. A) Briefly explains about the Measures of similarity.
   B) Explain the method of extracting the common factor loadings. (5+5)

7. A) Briefly explain about the Factor analysis and state its assumptions.
   B) What is hierarchical clustering? Explain the complete linkage algorithm with it. (5+5)

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